MC0092

HOSPITAL BUILDING NOTE 16

BOILER HOUSE AND STEAM BOILER PLANT

MINISTRY OF HEALTH : LONDON : HER MAJESTY'S STATIONERY OFFICE
REVISED JULY 1965 PRICE 2s. 0d. NET

Boiler House and Steam Boiler Plant

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An addendum to Appendix E of Hospital Building Note No. 2, *The Cost of Hospital Buildings*, which sets out cost recommendations for the Boiler House and Steam Boiler Plant, is supplied with this Building Note.

I. Scope

This Building Note gives guidance on the design of hospital boiler houses and steam boiler plants with installed capacities ranging from 6,000 to 70,000 lbs. of steam per hour. In many respects it is applicable also to high pressure hot water plant.

Although they are often accommodated in the boiler house building, this Note does not cover the provision of heating and hot water calorifier plants, the requirements for which vary substantially from hospital to hospital.

II. General considerations

Ready access to a main road is required for fuel deliveries and an approach distinct from the main hospital traffic is desirable.

A certain amount of noise inevitably accompanies the operation of main boiler plant: it is, therefore, undesirable to place it near patient areas or staff residences. Similarly, dust from coal and ashes must not be allowed to be a nuisance. Ideally, boiler plant should be remote from the main hospital buildings but, in order to reduce the length of main service pipes and ducts, it should be in a position convenient to the main steam users such as the laundry, kitchen and Central Sterile Supply Department. There are advantages in a low-level position in relation to the rest of the hospital, although this may necessitate a high chimney.

It is usual to group the boiler house, workshops, garages and similar accommodation together in a service area. The main water-storage tanks and (where provided) the water-softening plant should also be in this area if the levels are suitable, together with the calorifier and pumping plants, where these are centralised. These other services will be dealt with in a separate Note.

It is sometimes found convenient to place the incinerator chamber in the vicinity of the boiler house so that the flue may be embodied in the main chimney. Holding bays for materials awaiting incineration will be needed and, if the main ash dump is not adjacent, covered space for ashes.

In view of the increasing heat requirements of hospitals generally, the site should allow for future extension of the buildings. Where the need for an additional boiler can be foreseen because of some projected redevelopment or other change of circumstances, a spare boiler bay should be included in the layout.

Framed structures with light cladding of acceptable materials and design are normally adequate to house boiler plant, but the lower six feet at least should be of brickwork or otherwise strengthened to withstand the rough treatment which the walls of boiler houses receive. Attention should be given to sound absorption and noise control with this type of construction. Exceptionally, more elaborate buildings may be necessary.

Scale models of buildings and plant, complete with pipes and fittings, are useful for indicating the working clearances and accessibility of proposed layouts: advice on the preparation of models can be obtained from the Building Research Station.

III. List of rooms etc.

A. Basic

These should be provided in all cases and should consist of the following:

(*a*) Boiler room

(*b*) Fuel store

(*c*) Ash dump

(*d*) Chimney

(*e*) Switch room

(*f*) Mess room

(*g*) Staff lockers and lavatories

(*h*) Circulation space necessary for the above accommodation.

Functional unit

The functional unit selected for the basic items in this Note and the related Cost Note (supplied herewith as an addendum to Appendix E of Building Note No. 2) is the installed capacity of the plant expressed in pounds of steam per hour from and at 212° F.

B. Additional

In addition to the basic list the following may be required in some instances:

(*a*) Calorifier room

(*b*) Feed water treatment room

(*c*) Chemical store.

IV. Description of rooms etc.

A. Basic

(*a*) *Boiler room*

The boiler room should have good natural lighting and ventilation, with impervious non-slip floor and hard wall surfaces to a height of at least 6 ft. above the floor. It should be designed to allow for the easy replacement of boilers and other bulky equipment without serious disturbance to the functioning of the remaining plant.

The ventilation of the boiler room must be adequate (i) to supply air for maintaining combustion and (ii) to remove excess heat.

(i) Air for combustion is often provided through permanent ventilators in the walls. It is then good practice to arrange the air entry at the back of the boilers so that air is pre-heated as it flows towards the furnaces; this also reduces the cold draughts which are often a nuisance to stokers. A further slight increase in efficiency can be obtained by drawing warm air from above the boilers by the provision of suitable ducts.

(ii) Excess heat can usually be removed by means of high level or roof ventilators, doors and opening lights. Large areas of glazing should be avoided as they tend to promote excessive solar heat gain.

Foundations and pipe trenches for boilers and plant will be required, as well as a blow-down pit (see Section V—Plant) outside the building. Where mechanical handling of fuel is installed, a boot for the coal elevator, with adequate drainage facilities, will be required. Ventilated boiler rafts may be needed in circumstances where excessive heat would otherwise be transmitted to the subsoil with consequential damage to the foundations.

In addition to the areas occupied by equipment, sufficient space is required for the operation and maintenance of the plant—e.g. in front of economic boilers for the renewal of smoke tubes, the handling of cleaning equipment and the withdrawal of mechanical stokers. The space needed for these operations can be reduced if doors or opening windows face a boiler but such economies should only be sought if exceptional space restrictions make it necessary. If coal-fired boilers are used, grit has to be removed at intervals from combustion chambers, flues and (where fitted) grit arrestors; access for barrows is therefore required.

Figure 1 in the Appendix illustrates a diagrammatic layout of a boiler house. A guide to the minimum dimensions is given in Table 1.

(*b*) *Fuel store*

Facilities for the storage of fuel should be provided near the boiler house as an insurance against interruption of fuel deliveries. Enough for three weeks' consumption at average winter load is suggested as a maximum and enough for ten days consumption is recommended as a minimum.

For solid fuel, the storage should be in covered bays. Each bay should be partitioned from those adjoining and units 12 ft. wide by 35 ft. deep (i.e. some fifty tons capacity at 6 ft. stacking height) are suggested; they should be provided with roof lights and ventilation, and floors should be laid to fall for drainage. To facilitate stacking and the conveyance of the fuel to the boiler plant, it may be desirable to have a suitable stacking and transporting vehicle.

For liquid fuel, cylindrical storage tanks are preferable to rectangular tanks, since they are cheaper and easier to support and maintain. Guidance on construction, siting and installation of oil storage tanks is given in BS.799:1953. Total storage should comprise two or more tanks with separate filling connections to facilitate settling and de-sludging operations.

(*c*) *Ash dump*

For coal-fired plant below 18,000 lbs. steam/hr. installed capacity, a covered enclosure should be provided adjacent to the boiler room for ashes awaiting removal. Water spray equipment is required for quenching hot ashes and to lay dust. For larger plant an elevated ash hopper should be provided (see Section V—Plant).

(*d*) *Chimney*

See Section V—Plant.

(*e*) *Switch room*

The whole of the main switchgear serving the boiler house and plant should be contained in a small room or cubicle. Adequate ventilation should be provided and there should be 3 ft. 6 ins. of working space in front of the switchgear.

(*f*) *Mess room*

A mess room of 120-150 sq. ft. should be provided in a position which overlooks the firing floor of the boiler room. A bay with a sink, small cooker and storage space is needed.

(*g*) *Staff lockers and lavatories*

Sanitary accommodation comprising w.c., basin and shower will be required. Clothes lockers should also be provided.

(*h*) *Circulation space*

B. Additional

(*a*) *Calorifier room*

Space may be needed for calorifiers next to the boiler room.

(*b*) *Feed water treatment room*

Where feed water treatment by other than a simple dosing method is necessary, a separate room will be required. It should have an impervious non-slip floor.

(*c*) *Chemical store*

A room fitted with bins and/or bays for chemicals may be needed, with access to the feed water treatment room.

V. Plant

General

Steam is a convenient and flexible medium for space heating, hot water supply, sterilising, kitchen and laundry equipment etc., and the provision of a main steam boiler plant is usual for hospitals of more than about 120 beds.

Selection of fuel

The choice of fuel for a boiler plant is governed by what is available and its price in relation to quality. Hospital authorities have been advised separately of the principles and procedure to be followed in deciding whether new boilers should use oil or solid fuel.

The choice made between available solid fuels will depend on price, calorific value and ash content. The fuel selected will determine the choice of mechanical firing equipment.

Among liquid fuels the heavy oils, which are the cheapest of the grades available, are normally satisfactory for hospital use. Low sulphur oils which are dearer may be justified in exceptional circumstances.

Creosote pitch (CTF200) has also proved to be a suitable fuel for hospital boilers, although slightly more difficult to use than oil. Supplies, however, are limited, and the cost is substantially higher than that of heavy fuel oil.

Type of boiler

The magnitude of hospital steam loads is such that individual boiler ratings do not normally exceed 15,000 lbs. per hour. The normal working steam pressure is 100 p.s.i., or 120 p.s.i. at hospitals where there is a laundry.

The type of boiler most suited to hospital use is one which meets the following requirements:

(i) reliability;

(ii) efficiency;

(iii) ease and simplicity of maintenance;

(iv) ability to meet fluctuating steam demand;

(v) reasonably long life;

(vi) compact construction;

(vii) simple foundations;

(viii) low cost, compatible with (i) and (ii) above.

The economic type multi-tubular shell boiler meets many of these requirements. Fired by suitable automatic equipment, it is able to deal with moderate steam peaks and has proved to be very suitable for use in hospital boiler houses. The Lancashire boiler, although still in common use, has become less popular because of its high cost and heavy space and maintenance requirements. Water-tube boilers are best suited for steam loads considerably greater than those usually met in hospitals and are, therefore, seldom used.

In recent years the compact type "package" boiler, complete with firing equipment, feed pump and automatic controls, has gained in popularity, and boilers of this type at normal rating are claimed to work at about 80 per cent efficiency. The quality of the feed water becomes a critical factor where steam outputs are high in relation to heating surface, and where these surfaces are not accessible for examination and test. Where it is decided to employ compact type boilers they should be of proved reliability and suitability for hospital conditions and be designed so that all their heating surfaces are accessible for maintenance.

Other types of boilers (e.g. thermal storage) may be equally or more suitable in a particular case.

Number of boilers

To allow for plant being out of use during maintenance periods and as a safeguard in the event of breakdown, it is desirable to provide steam raising capacity above the estimated maximum demand. The margin of standby capacity provided will vary with the size of the plant. The requirements of plants not exceeding 10,000 lbs. steam/hr. installed capacity are probably best met by the provision of two boilers, each of which can supply, at the easy firing rating, 75 per cent of the maximum steam load. If this arrangement is not suitable to meet summer night load requirements, the installation of three vertical type boilers with mechanical firing should be considered. For plants from 10,000 to 35,000 lbs. steam/hr. installed capacity, three boilers of equal size are usually installed, any two of which will meet the maximum load. For large boiler plant, where four or five boilers of equal size may be installed, it is usual to have one boiler in reserve.

A complication, associated mainly with oil firing, is the tendency of plant to emit smuts when operating at very light loads, such as the summer night load. This may be due to inefficient combustion and low temperature flue surfaces causing condensation of the flue gases. This difficulty might be overcome by providing a smaller flue for summer working and a small boiler for use with light loads. The other boilers could be increased in size so that when one is out of service the remainder, together with the small boiler, would be capable of meeting the maximum load at their rated normal output.

Economic boilers are best worked at an easy steaming rate of 80-85 per cent of their rated output and the boiler plant should normally be capable of supplying the hospital load at this rate. Hospital steam loads vary considerably throughout the year, however, and it is not possible for this easy steaming rate to apply over the whole period. Peak loads occur only when the weather is exceptionally cold, and at these times there can be no objection to the boilers working at their full rated outputs, especially where standby plant is available.

Automatic controls

For the smaller plants automatic controls, which allow the boilers to be operated without constant attention, are being used more and more. These controls need a high standard of maintenance with frequent expert inspection and overhaul of the equipment. In considering the use of these devices it must be borne in mind that a continuous and reliable steam and heat supply is the first requirement of a hospital boiler plant. The controls should always have the prior approval of the boiler insurer.

Special requirements of coal-fired boiler plants

Mechanical stokers

Mechanical stokers are recommended for use in hospital boiler houses as they have many advantages over hand-firing methods. For example they handle a quantity of fuel far beyond the capacity of a fireman, thus enabling a greater number of furnaces to be controlled with less labour. Also by reducing the amount of excess air entering the furnace, they achieve a higher average percentage of CO_2 in the flue gases than is obtained with hand-firing. The saving in the consumption of fuel due to the adoption of mechanical firing with automatic combustion control can be of the order of 10-15 per cent.

By an order made under Section 11(4) of the Clean Air Act, mechanical stokers are exempt from the provisions of Section 11 of the Act.

Choice of mechanical stoker

The characteristics of the fuel to be used will largely determine the choice of grate and handling equipment. Particular attention must be paid to ash content.

Although various systems of mechanical firing are available for shell boilers, two main types have proved to be very suitable for use with economic type boilers installed in hospitals. They are the coking stoker and the chain-grate stoker.

The coking stoker is the cheaper of the two. It has simpler and cheaper automatic controls, and the boiler to which it is fitted can be hand-fired in the event of a breakdown (though the boiler steaming rate will then be reduced). It is of robust construction and can handle a reasonable variety of coals.

The chain-grate stoker is capable of handling inferior fuel almost smokelessly and can be operated over a wide range of loads. When there is an assured supply of cheap, poor quality coal, its use can be justified.

Mechanical handling

The hoppers of mechanical stokers are increasingly being fed by mechanical means. For hospital boiler plants generating more than 10,000 lbs. of steam per hour, the provision of a mechanical elevator and cross conveyor is recommended. There are advantages in maintenance and quieter running in the provision of one elevator per boiler, but this would be a special provision. For boiler plants generating up to 10,000 lbs. of steam per hour, the provision for each boiler of a simple mechanical elevator of the " worm-in-tube " type will reduce the amount of labour required. Exceptionally-overhead bunkers to hold sufficient fuel for overnight or week-end working may be provided where the noise of elevators and conveyors would be objectionable during these periods. Where the natural slope of the ground adjacent to the boiler house is such that coal lorries could unload directly into over-the-boiler bunkers, this would in any case be the method chosen for feeding the stoker hoppers.

Ash removal arrangements

The arrangement for boiler plants below 18,000 lbs. steam/hr. installed capacity is described in Section IV—Description of rooms etc. For capacities between 18,000 and 50,000lbs. steam/hr. the installation of a closed hopper at high level is recommended, filled by a belt conveyor or skip hoist and capable of discharging directly into a lorry underneath. For larger plants an automatic system of ash removal from boilers to hopper may be considered.

Grit arrestors

Boiler plants having a maximum steam load in excess of 15,000 lbs. per hour should have grit arrestors to minimise the emission of grit and dust. Properly installed cyclone arrestors or dust collecting induced-draught fans of correct design will normally be satisfactory. These should be designed to give optimum efficiency at 75 per cent of the maximum boiler output.

Soot blowers

Soot blowers should be provided with all coal-fired boilers of the economic type. Vacuum cleaning plant is commonly used to remove soot, flue dust and grit from the boilers.

Special requirements of oil-fired boiler plants

Choice of oil-firing equipment

The oil-firing equipment must be suitable for hospital use. Important considerations are:

(*a*) Steam loads vary during the day and night and the equipment should have a guaranteed performance, with air/oil ratio maintained automatically to give high combustion efficiency over the range of loads.

(*b*) Burner flames should not impinge on the furnace.

(*c*) The burner should have good atomising properties.

(*d*) The noisiness of the equipment.

The simple pressure jet burner does not fulfil all these requirements. The extra cost of suitable types is, however, offset by better performance and greater efficiency.

Relief doors

Where practicable, relief doors should be fitted to combustion chambers and flues. It is better to provide several relief doors in suitable positions than one very large relief door.

Automatic damper control

An automatic draught control system facilitates the maintenance of correct air/fuel ratios over a wide range of loads. This not only improves combustion efficiency (thus reducing smoke emission) but also helps to prevent condensation, a risk which is greater at times of light load.

It is essential with such a system that the damper should be interlocked with the fuel supply or be so arranged that the plant cannot be started up or operated with a closed flue. The control should always have the boiler insurer's approval.

Fire precautions

Automatic fire valves as recommended in B.S.799: 1953 should be provided in any oil pipe lines from the tanks.

Fire alarms and fire-fighting equipment

Suitable extinguishers and sand buckets should be provided in easily accessible positions near the storage tanks and burners. Information on fire alarms and extinguishers is given in B.S. Codes of Practice and in H.M.(56)36 on Hospital Fire Precautions. Advice on the fire-fighting installation proposed should be sought from the local fire authority. Some local authorities require oil storage installations to be provided with permanent foam pipes, with external inlets for fire brigade use, or a system of emulsifying sprinklers.

Engineering requirements common to both coal and oil-fired boiler plants

Instrumentation

Advice on the instrumentation of hospital boiler houses is given in Hospital Technical Memorandum No. 5, Steam Boiler Plant Instrumentation.

Blow-down pits

A watertight blow-down pit is required for steam boilers to intercept sludge and prevent the discharge of water into the drainage system at temperatures in excess of 150° F. The capacity is, therefore, governed by the amount of discharge to be held. These pits are usually of rectangular box shape divided into halves by a central weir. It is suggested that the first compartment be made at least large enough to hold the volume of water represented by 1 in. fall in the water level of the largest boiler. A vent pipe of 6 in. minimum diameter should be taken up to discharge above roof level.

The pit should be outside the boiler house adjacent to the blow-down valve(s). It should not be too close to the boiler house foundations because of the possibility of damage if the pit should crack and leak.

Access covers for cleaning must be provided. They should be either of the dead-weight type or should be clipped, locked or bolted down. The blow-down piping trench should be laid to falls to prevent water from re-entering the boiler house from the pit. A stuffing box should be provided where each blow pipe enters the pit, to allow for pipe movements due to expansion and contraction.

Hot well or boiler feed tank

The hot well or boiler feed tank is an essential part of a steam boiler installation. The tank should be covered and lagged to prevent loss of vapour and heat, and raised above the boiler feed pump suction. A water capacity sufficient for at least one hour's operation at full load is needed. The tank may be divided into two compartments to facilitate maintenance and cleaning. Standard fittings will normally include a water gauge, drain cock, vent pipe and overflow, and the necessary pipe connections. A pipe coil or heat exchanger for the reclamation of waste heat from steam-driven feed pump exhausts is usually fitted.

Where the boiler feed tank is of considerable size the space beneath it may be used to house the feed pumps or water treatment plant.

A separate cold water make-up tank is sometimes used.

Water treatment plant

Normally, feed water treatment by simple chemical dosing (together with regular blow down) will prove adequate. The chemicals should be introduced to the feed system in the proportions necessary having regard to the composition and quantity of make-up feed water.

Where the make-up water supply is unsuitable for treatment by simple chemical dosing, it will be necessary to install water treatment plant. The size, complexity and space needed for this plant will vary with the quantity of make-up, the degree of feed water treatment necessary and the type of water treatment selected. Specialist advice on this should be sought at an early stage.

Water treatment plant, where required, should be treated as an additional item for cost purposes.

Safety valve vent pipes

Safety valve vent pipes should preferably discharge above roof level. The open ends should be fitted with cowls, preferably visible from the firing floor. To reduce noise it may be necessary to terminate the vent pipes inside the boiler house. The boiler insurance companies should approve the arrangement.

Feed pumps

Two steam-driven feed pumps, each capable of pumping 25 per cent more than maximum boiler output, will normally provide the most satisfactory arrangement. For large plants it is desirable to install a third pump of smaller duty. It is also desirable to provide an electrically-driven standby pump, capable of handling 60 per cent of the output of one boiler, so that water can be pumped into the boilers under emergency conditions when the plant steam pressure has fallen to a level at which the steam pumps have become inoperative. An additional advantage is that this pump can, through suitable pipe connections, be used to circulate the boiler water when lighting up from cold and so reduce the excessive stresses which can occur in the boiler plant during this period. If the pumps are steam-driven, the heat in the exhaust steam should be recovered by means of a coil or heat exchanger unit in the feed tank.

As an alternative to steam pumps for the main duty, electrically-driven pumps may be considered. Whichever type of pump is installed, the feed to the boiler should be controlled by an approved type of automatic feed water regulator. Feed pumps are normally mounted on a concrete plinth.

Platforms and ladders

These should be sited to give maximum access with minimum platform space. One fixed ladder should be provided for each pair of boilers, each boiler having a platform running its full length. Further platforms and ladders may be required for access to plant such as feed tanks, oil storage tanks, etc.

Induced draught fans and ductwork

Where induced draught is required the provision of one induced draught fan for each boiler offers the greatest flexibility in meeting varying steam demands. Fan casings and all ductwork carrying boiler flue gases should be adequately insulated. In the case of oil-fired boilers a smaller flue will help to prevent formation of smuts on light loads.

Electrical installation

The choice of wiring installation lies between a mineral insulated copper clad cable system and metal trunking and conduit with butyl rubber wiring. Special wiring may be required for fuel pipe tracing, etc.

The main switchgear should be grouped in a small room or space adjacent to or in the boiler house. Large installations should have a separate busbar chamber. A three phase 4 wire A.C. supply is required for the operation of pump, fan and stoker motors.

Guidance on the design of electrical installations is given in Hospital Technical Memorandum No. 7, Electrical Services: Supply and Distribution.

Lighting

General lighting in the boiler house should have an average intensity of 10 lumens per square foot. A uniform arrangement of lights is not usually satisfactory because of the masking effect of overhead pipes, ducts, coal conveyors, etc. The lighting layout should be planned so that working areas, instrument panels, etc. are well-lit and glare-free. Fluorescent lighting should be used in higher intensity areas which are lighted for long periods.

Fittings should be of totally enclosed industrial pattern and capable of withstanding high ambient temperatures. Lighting fittings in internal and external fuel storage areas should be dust- and waterproof and all switches should be metal-clad.

Socket outlets (mains)

Sufficient 13A socket outlets at mains potential should be provided to allow the convenient use of portable electric tools in the working areas. Because of the serious electric shock risk associated with portable equipment connected with mains electricity, the sockets should be supplied from a mains isolating transformer and the circuit controlled by an earth leakage circuit breaker.

Sufficient extra-low voltage (e.g. 25V) socket outlets should be provided to allow the convenient use of inspection lamps. Units incorporating individual transformers have the advantage of eliminating voltage drop on low-voltage circuits.

Standby electricity supply for boiler plant

A central boiler plant which depends on a continuous electricity supply for its functioning and safety should be provided with a standby electricity supply to allow the plant to continue to provide services in the event of failure of the normal electricity supply. The standby supply should also be connected to operate the heating and hot water circulating pumps where these are conveniently located and provision should be included for emergency lighting to cover essential operating points in the boiler house.

Chimneys

Chimneys may be constructed of steel, reinforced concrete or brick. Unclad steel chimneys are not considered suitable for hospitals because, with this type of chimney, there is a rapid cooling of the gases which leads to condensation and smut formation.

This effect can be offset by the provision of an outer cover of bright aluminium sheet or an alternative form of thermal insulation.

Reinforced concrete chimneys are comparatively common nowadays. However, when less than 200 ft. high, they are usually more costly than brick chimneys.

For most hospitals the chimney will be of brick with a circular cross section as this offers least wind resistance and is usually cheaper to build. The lining of the chimney should be suited to the type of fuel used and anticipated operating temperatures. To prevent downwash of the flue gases, the top of the chimney should be as slender as possible and be free from large overhangs. A suitable capping and approved lightning arrestor should be fitted.

To reduce the risk of smut formation with oil-fired plant it may be necessary to provide a dual flue chimney stack, one flue being sized to suit summer loads. In some cases, the incinerator flue will also be embodied in the boiler plant chimney. This may result in the chimney stack having three separate flues. Normally, these flues will not be carrying gas of similar composition or temperature or even be in use simultaneously. Stresses will arise due to differential temperatures and the chimney must be designed to withstand them.

It is suggested that flue gas velocities should be between the limits of 15 and 40 ft. per second for minimum and maximum rates of firing. Gas velocities in excess of 40 ft. per second require excessive fan power and will not normally be justifiable.

Chimneys should rise sufficiently above the nearby buildings to ensure that the flue gases emerging are not appreciably affected by down-draughts. Where there is doubt about the effect of adjacent tall buildings or hills, wind tunnel tests are desirable to determine the best height and position of the chimney.

Where the chimney is part of the boiler house, it should extend at least 10 ft. above the highest point of the building.

The following table, based on recommendations made by a Working Party of technologists appointed by the Air Pollution Panel of the Federation of British Industries, gives a guide to chimney heights.

Maximum continuous rating of boiler plant (excluding overloads of short duration)	*Minimum chimney height*
1,000 *lbs. per hr. steam or million B.t.u. per hr.*	*Feet*
Up to 5	60
5.1-12	80
12.1-21	100
21.1-70	120

It is necessary, however, that the local planning authority should be consulted on this matter and reference should be made to the Memorandum on Chimney Heights (SO Code No. 75-115) issued in 1963 jointly by the Ministry of Housing and Local Government and the Scottish Development Department. This memorandum includes a method of calculation based on the amount of flue gases which the chimney is expected to emit as a function of the maximum rate of emission of sulphur dioxide and the achievement of specified flue gas velocities.

Chimney heights determined by this formula, and corrected for the type of district in which the boiler plant is installed and the height and extent of the surrounding buildings, are generally greater than those recommended in this Building Note, especially for the larger plants burning heavy fuel oil with a sulphur content approaching 4 per cent of weight and sited in densely populated industrial areas.

Chimney heights calculated by this method are not intended, however, to be rigidly applied in all circumstances. The provisions in this Building Note to ensure adequate boiler plant equipment, instrumentation and optimum combustion control over wide ranges of load conditions should be emphasised in negotiations between hospital planning authorities and local authorities responsible for final decisions on chimney heights.

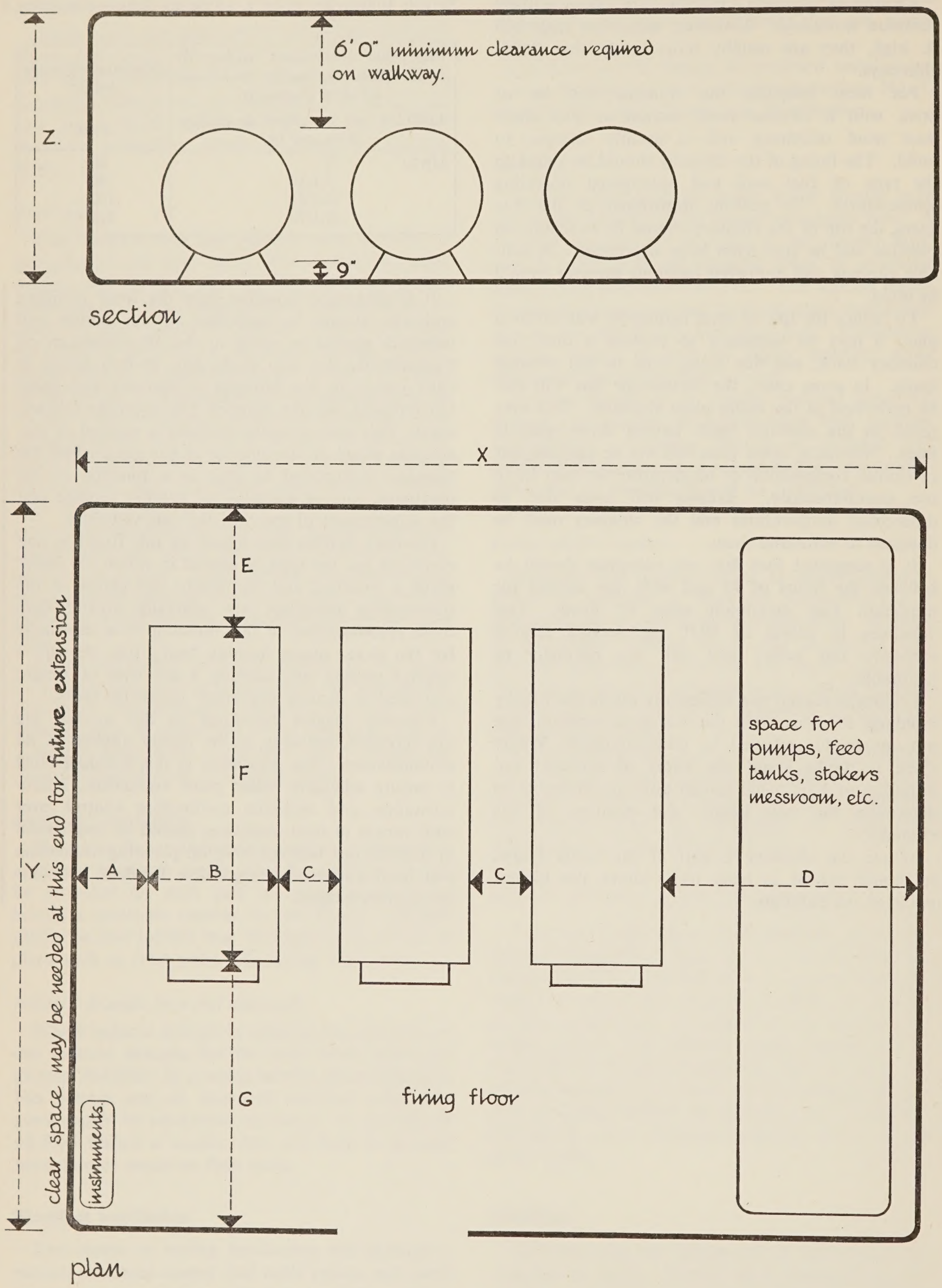

FIGURE 1. Suggested layout of a boiler house. The dimensions are given in Table 1.

TABLE 1

This table is a guide to the minimum dimensions for the boiler house layout shown in Figure 1. The actual sizes and arrangement will depend on local considerations.

Boilers No. Size	*Dimensions shown in Figure* 1									
	A	B*	C	D	E	F	G	X	Y	Z
2 × 3,000	5′ 0″	7′ 0″	4′ 0″	16′ 0″	8′ 0″	15′ 6″	11′ 6″	39′ 0″	35′ 0″	13′ 9″
2 × 5,000	5′ 0″	8′ 0″	4′ 0″	16′ 0″	8′ 0″	17′ 6″	13′ 6″	41′ 0″	39′ 0″	14′ 9″
3 × 5,000	5′ 0″	8′ 0″	4′ 0″	16′ 0″	8′ 0″	17′ 6″	13′ 6″	53′ 0″	39′ 0″	14′ 9″
3 × 6,000	5′ 0″	8′ 3″	4′ 0″	16′ 0″	8′ 0″	19′ 0″	14′ 6″	53′ 9″	41′ 6″	15′ 0″
3 × 7,000	5′ 0″	8′ 6″	4′ 0″	16′ 0″	8′ 0″	19′ 0″	14′ 6″	54′ 6″	41′ 6″	15′ 3″
3 × 8,500	5′ 0″	9′ 0″	4′ 0″	16′ 0″	8′ 0″	19′ 0″	14′ 6″	56′ 0″	41′ 6″	15′ 9″
3 × 10,000	5′ 0″	9′ 6″	4′ 0″	16′ 0″	8′ 0″	22′ 0″	16′ 6″	57′ 6″	46′ 6″	16′ 3″
4 × 10,000	5′ 0″	9′ 6″	4′ 0″	16′ 0″	8′ 0″	22′ 0″	16′ 6″	71′ 0″	46′ 6″	16′ 3″
4 × 12,500	5′ 0″	10′ 6″	4′ 0″	16′ 0″	8′ 0″	22′ 0″	16′ 6″	75′ 0″	46′ 6″	17′ 3″
4 × 15,000	5′ 0″	11′ 6″	4′ 0″	16′ 0″	8′ 0″	22′ 0″	16′ 6″	79′ 0″	46′ 6″	18′ 3″
5 × 14,000	5′ 0″	11′ 0″	4′ 0″	16′ 0″	8′ 0″	22′ 0″	16′ 6″	92′ 0″	46′ 6″	17′ 9″

*Note: Dimension " B " includes 6″ for thermal insulation on boiler shell. The dimensions applicable to size of boiler are based on the use of three-pass Economic boilers of normal design taken from makers' catalogue ratings from and at 212°F. The dimensions of boilers of special type may vary widely from those in the table.

Hospital Building Note No. 2. Appendix E

Boiler House and Steam Boiler Plant

Hospital Building Note No. 16

The scales of accommodation and cost recommendations are applicable to solid fuel or oil-fired boiler plant ranging from 6,000 to 70,000 lbs. of steam per hour installed capacity.

A. Basic

(*a*) Boiler room

(*b*) Fuel store

(*c*) Ash dump

(*d*) Chimney

(*e*) Switch room

(*f*) Mess room

(*g*) Staff lockers and lavatories

(*h*) Circulation space necessary for the above accommodation

B. Additional

(*a*) Calorifier room

(*b*) Feed water treatment room

(*c*) Chemical store

Circulation space

For the purpose of the provisional cost limit the area occupied by internal circulation space and internal walls and partitions represents, on average, an addition of 4 per cent to the net floor area of the basic and additional accommodation.

DEPARTMENTAL COST ALLOWANCES

1. Basic

Functional unit—the installed capacity of the plant expressed in pounds of steam per hour from and at 212° F.

For boiler houses having an installed capacity of less than 40,000 lbs. steam/hr.:

For the first 6,000 lbs./hr.—allow £35,200

For each additional 1,000 lbs./hr.—allow £2,050

For boiler houses having an installed capacity of 40,000 lbs. steam/hr. and over:

For the first 40,000 lbs./hr.—allow £106,100

For each additional 1,000 lbs./hr.—allow £1,510

2. Additional

Cost of additional accommodation—allow £4 18s. 0d. per square foot

Notes:

1. *Chimneys.* The departmental cost allowances include costs for single flue stacks.

2. *Engineering.*

(*a*) Basic

The engineering services included in Item 1 above are for a complete boiler plant with the components detailed below. Where more elaborate provision is required, e.g. overhead coal bunkers, automatic ash removal, the extra cost would need to be justified separately and treated as an additional item.

Boilers, three pass economic type with fittings, mountings and boiler stools. Induced draught fans with electric motors and control gear, integral grit arrestors for coal-fired plant of 21,000 lbs. steam/hr. capacity and over.

Boiler flue ducting between boiler outlet flues and induced draught fans and between fans and chimney stack. Ventilation ducting as required.

Mechanical stokers, low ram type, for coal-fired plant.

Oil-burning equipment, low pressure air type, for oil-fired plant, complete with pumping and heating unit.

Fuel oil storage tanks, complete with outlet heaters and sludge heating coils. Horizontal cylindrical type, two, three or four tanks for plant up to and including 25,500 lbs. steam/hr.; vertical cylindrical type, two tanks for larger plant.

Screw type coal elevators, one per boiler for plant below 18,000 lbs. steam/hr., coal elevator and cross conveyor for larger plant.

Overhead ash storage bunker, five, ten or fifteen tons capacity to suit size of plant of 18,000 lbs. steam/hr. and upwards, complete with skip hoist, supporting steelwork and discharge valve and chute.

Water feed tank and supports complete with fittings, including ball valve controlled make-up feed compartment, and exhaust steam feed heating coil.

Feed pumps, steam reciprocating double acting type, with standby feed pump electrically driven.

Soot blowers for coal-fired boilers. Suction cleaning equipment for oil-fired boilers.

Insulation on boilers, flue ducting, feed tank, steam feed and condensate, blow-down and oil circulation piping as required.

Platforms, ladders and handrails.

Instrumentation in accordance with Hospital Technical Memorandum No. 5, Hospital Steam Boiler Plant Instrumentation.

Emergency electricity supply for the boiler plant in accordance with Hospital Technical Memorandum No. 11, Emergency Electrical Services. (The standby generator, switch-gear and external cables are excluded.)

Electric lighting and power including fittings, telephone and fire alarm system.

All piping, valves and fittings within the boiler house for steam and exhaust, feed and condensate, blow-down, drain, water, fuel oil filling, transfer and circulating services.

Hot, cold and drinking water.

Fire fighting equipment.

Space heating and cooker in mess room.

The above engineering services account for the following approximate percentages of the total cost of basic accommodation:

54-55 per cent—for solid fuel plant of less than 15,000 lbs. steam/hr. capacity.

61-68 per cent—for solid fuel plant of 15,000 lbs. steam/hr. capacity and over.

66-72 per cent—for oil-fired plant.

(*b*) Additional

The following engineering services are included in item 2 above and account for approximately 10-12 per cent of the total cost of additional accommodation:

Electric lighting.

Space heating.

Hot and cold water.

Note:

Cost allowances have been revised to take account of the increases operative from 1st May 1963 and the decrease due to the deletion of the standby electricity generator, as indicated above.

Ministry of Health

The following titles in these series have been issued:

Prices in brackets include postage

Hospital Building Notes

1. Buildings for the hospital service	Out of print	
2. The cost of hospital buildings	4*s* 0*d*	(4*s* 6*d*)
3. The district general hospital	(in prep.)	
4. Ward units	(in prep.)	
5. Short stay psychiatric unit	(in prep.)	
6. Diagnostic X-ray department	(in prep.)	
7. Accommodation for nursing staff	Out of print	
8. Physiotherapy department	(in prep.)	
9. Occupational therapy department	1*s* 3*d*	(1*s* 6*d*)
10. Kitchens	2*s* 0*d*	(2*s* 5*d*)
11. Dining rooms	1*s* 3*d*	(1*s* 6*d*)
12. Out-patient department	1*s* 6*d*	(1*s* 11*d*)
13. Central sterile supply department	1*s* 6*d*	(1*s* 9*d*)
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15. Pathology department	2*s* 0*d*	(2*s* 5*d*)
17. Deep plan (race track) ward units	2*s* 0*d*	(2*s* 5*d*)
18. Administrative department	2*s* 6*d*	(2*s* 11*d*)
19. Department of medical photography and medical illustration	1*s* 6*d*	(1*s* 9*d*)
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32. Psychiatric ward (type 2) and pre-discharge (hostel type) ward	3*s* 6*d*	(4*s* 0*d*)

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8. Physiotherapy department	3*s* 0*d*	(3*s* 5*d*)
9. Occupational therapy department	3*s* 0*d*	(3*s* 5*d*)
10. Kitchens	3*s* 6*d*	(3*s* 11*d*)
11. Dining rooms	2*s* 0*d*	(2*s* 5*d*)
12. Out-patient department	5*s* 0*d*	(5*s* 6*d*)
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Ministry of Health hospital guidance publications include: Hospital Building Notes; Equipment Notes; Design Notes; Building Bulletins and Technical Memoranda.

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Printed in England for Her Majesty's Stationery Office by The Campfield Press, St. Albans

Dd. 110104. K.40. 8/65.

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Published by
HER MAJESTY'S STATIONERY OFFICE

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